

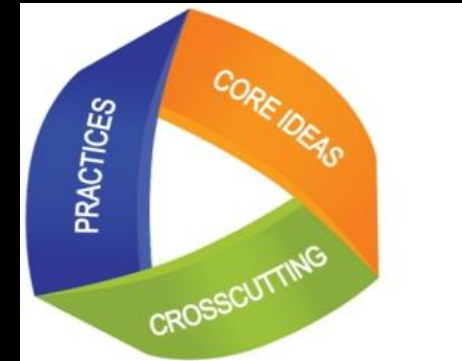


Next Generation Science Standards

NEXT GENERATION SCIENCE STANDARDS (NGSS)

K–12 science standards were developed through a collaborative state led effort

NGSS Focus on a Three Dimensional Learning Model



All K–12 students should master these concepts in order for success in college & career.

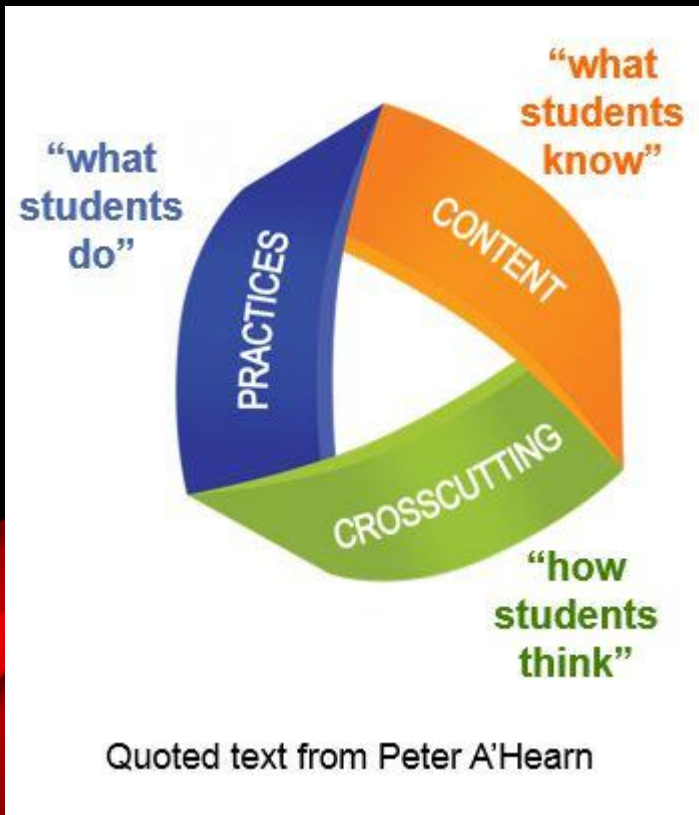
COHERENT LEARNING PROGRESSIONS



- Engagement in deeper learning of content.
- Builds on knowledge & skills developed at each grade level.
- Allows for revisiting concepts to deepen understanding.

NGSS allows the learner to apply learning in context.

THREE DIMENSIONAL LEARNING



- Scientific & Engineering Practices
- Crosscutting Concepts
- Core Ideas



Practices are the behaviors that scientists engage in as they investigate and build models and theories about the natural world and the behaviors that engineers use as they design and build models and systems.

SCIENTIFIC & ENGINEERING PRACTICES



Crosscutting concepts are concepts that have application across all disciplines of science. As such, they provide a way of linking the different disciplines of science.

Making connections to the BIG idea.

CROSSCUTTING CONCEPTS

Crosscutting Concepts

1. Patterns
2. Cause & Effect
3. Scale, Proportion & Quantity
4. Systems & System Models
5. Energy & Matter
6. Structure & Function
7. Stability & Change



Thinking, speaking, and writing
like scientists and engineers.

Based on the pattern that
I see I conclude...

One way key parts of this
system work together is...

How Can You Explain This? A Fogged Mirror



Disciplinary core ideas are the big ideas of science that provide scientists and engineers with the concepts and foundations to make sense of phenomena or design solutions to problems.

DISCIPLINARY CORE IDEAS

Performance
Expectations

Disciplinary
Core Ideas

Crosscutting
Concepts

Science &
Engineering
Practices

| 3-LS3 Heredity: Inheritance and Variation of Traits | | |
|--|--|--|
| 3-LS3 Heredity: Inheritance and Variation of Traits | | |
| Students who demonstrate understanding can: | | |
| 3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. [Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.] | | |
| 3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment. [Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pig that is given too much food and little exercise may become overweight.] | | |
| The performance expectations above were developed using the following elements from the NRC document <i>A Framework for K-12 Science Education</i> : | | |
| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. <ul style="list-style-type: none">Analyze and interpret data to make sense of phenomena using logical reasoning. (3-LS3-1) Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. <ul style="list-style-type: none">Use evidence (e.g., observations, patterns) to support an explanation. (3-LS3-2) | LS3.A: Inheritance of Traits <ul style="list-style-type: none">Many characteristics of organisms are inherited from their parents. (3-LS3-1)Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3-LS3-2) LS3.B: Variation of Traits <ul style="list-style-type: none">Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1)The environment also affects the traits that an organism develops. (3-LS3-2) | Patterns <ul style="list-style-type: none">Similarities and differences in patterns can be used to sort and classify natural phenomena. (3-LS3-1) Cause and Effect <ul style="list-style-type: none">Cause and effect relationships are routinely identified and used to explain change. (3-LS3-2) |
| <i>Connections to other DCIs in third grade: N/A</i> | | |
| <i>Articulation of DCIs across grade-levels: 1.LS3.A (3-LS3-1); 1.LS3.B (3-LS3-1); MS.LS1.B (3-LS3-2); MS.LS3.A (3-LS3-1); MS.LS3.B (3-LS3-1)</i> | | |
| <i>Common Core State Standards Connections:</i> | | |
| ELA/Literacy – | | |
| RI.3.1 | Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-LS3-1),(3-LS3-2) | |
| RI.3.2 | Determine the main idea of a text; recount the key details and explain how they support the main idea. (3-LS3-1),(3-LS3-2) | |
| RI.3.3 | Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS3-1),(3-LS3-2) | |
| W.3.2 | Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (3-LS3-1),(3-LS3-2) | |
| SL.3.4 | Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. (3-LS3-1),(3-LS3-2) | |
| Mathematics – | | |
| MP.2 | Reason abstractly and quantitatively. (3-LS3-1),(3-LS3-2) | |
| MP.4 | Model with mathematics. (3-LS3-1),(3-LS3-2) | |
| 3.MD.B.4 | Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. (3-LS3-1),(3-LS3-2) | |

Connections
to other
standards

IN THE CLASSROOM

Shift from

**Teacher 'telling students'
or
Students 'learning about'**



**Students making
sense of
the science**

Discourse in the classroom
Accountable Talk
Talk moves
Turn and Talk



Helps students make sense of the science.

IN THE CLASSROOM

A unit's instruction begins with an observable phenomena that needs explanation.

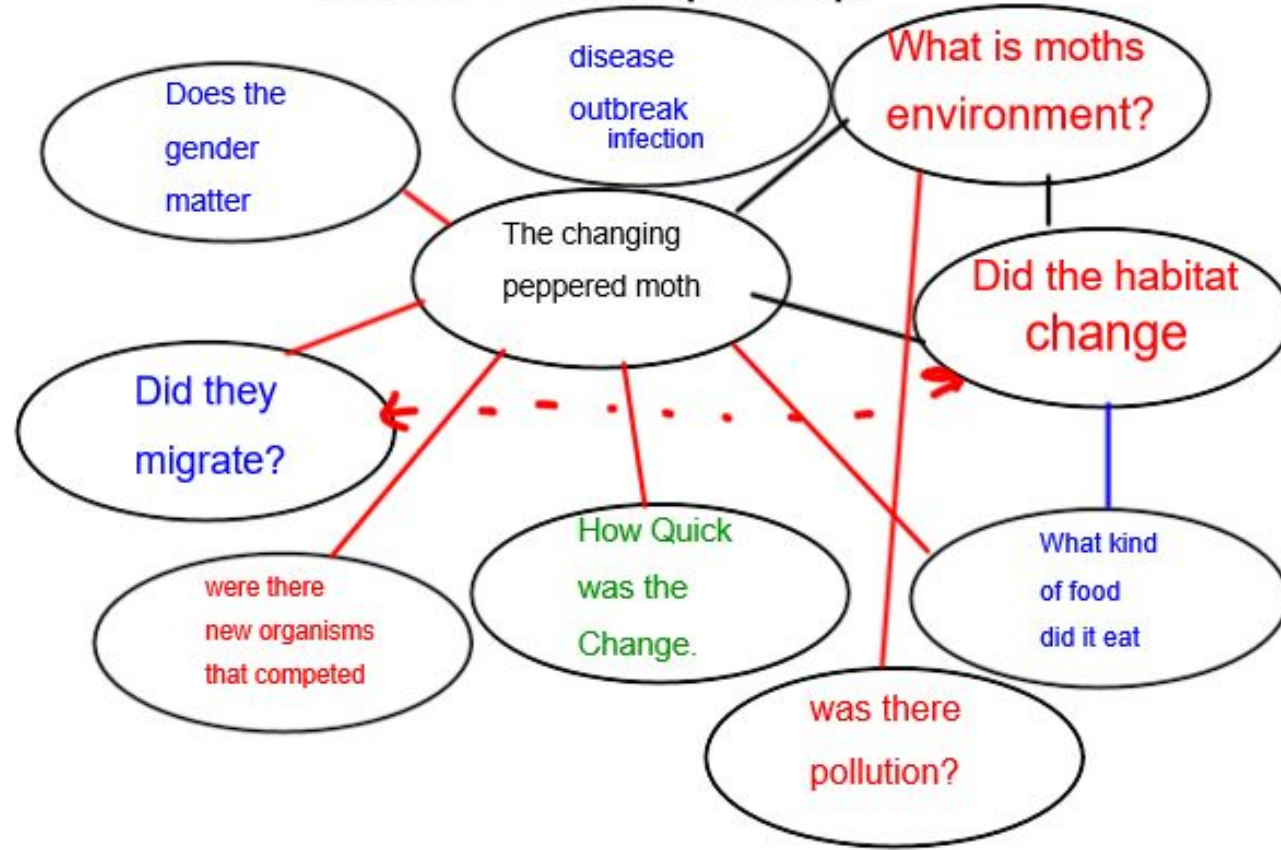
For example:

- **Why are there fossils on the top of Mount Everest?**
- **Why did peppered moths in England turn from white and black speckles to mostly gray by 1900 ?**
- **Why does a slug 'melt' when it meets salt?**

Why did the moths change from speckled to gray?



Class 4 concept map



Asking questions

Students explain what they think they understand about the question by building models and asking questions.

IN THE CLASSROOM

Student understanding guides the course of investigations.

Each investigation, reading, image or video clip helps to build the bigger picture.

“What does this new information tell us about the phenomenon?”



In this process

- Revisit their initial models
- Make claims justifying with evidence & reasoning
- Dialogue allows the class to build understanding of the science concept.

Why do species change over time and should we intervene?

peppered Moths

Species change over time, for example the peppered moths changed over a short period of time and they changed their color to blend in better with the environment. Species also change if their environment changes and if what they eat changes, including all these things that have and why. There is also human species change, changes in the genes, including mutations and breeding.

Should we intervene?

I think that we should not intervene because the species are changing for a reason and if we stop these changes then animals will die because of the reasons above and below.

Without protection what they eat.

Without these species will die.

First example: I know how the population adapts because the peppered moths adapted by more like the environment. Adaptation is when a organism adapts to new condition and that's what the peppered moths did which supports my claim because...

Second example: I know how natural selection works because it causes change. It causes we learned about Darwin's finches. Darwin's finches live on islands in the Galapagos. On each island there are finches with different beaks and only eat what they can eat. Some have bigger beaks and smaller seeds. Some have smaller beaks and some times the small seeds. It all depend on which is the greater food source that day. So some birds are survives more than the other. They are natural selection. It's part of the survival of the fittest.

Third example: I think that evolution causes change because in the past humans we took a lot of amount of time and saw how many we had and how the species changed over time. Evolution is when a organism adapts and grows from its original form. Over a long period of time the birds grew in species and some died off. That is an example of evolution. This...

Fourth example: I think that the peppered moths were not a complete of genetic modification because they changed the color of their wings or genes. In class we learned about breeding dogs so we picked the dogs that had the best traits and bred them. When we bred dogs, we bred the best traits and bred the best traits.

The Change in Peppered Moths

1700s

Claim: The peppered moths changed from being white and speckled to completely black, because their environment changed since the ground turned black from the soot.

1800s

Before

After

Adapting Population

More evidence

Evidence to Support

1. The bead bug experiment showed that they do adapt to fit in with their surroundings and only some did good and others didn't. This also shows that the type that does the best reproduces and therefore more of them.

2. We know that in the 1850s there was an industrial revolution. The soot from the buildings and the coal made the ground black.

3. We know it is possible for species to adapt because of Charles Darwin's discovery at the Galapagos island. The finches that had the best beak for each season did better. This is also known as "survival of the fittest".

Natural Selection

Once the environment has completely changed to black, the moths adapt so it blends in with the ground better. Because the peppered moths can't rely on camouflage, most of the moths with speckles die off leaving the black moths to thrive. Only the moths with the specific trait (black wings) will survive.

Evolution Over Time

Evolution occurs over time because if a moth can't just magically change colors it takes time for the color that is surviving to reproduce.

Breeding or Genetic Modification?

We think it is genetic modification because the moths' genes changed. The color of their wings changed/modifies.

Adaptation: Breeding or Genetic Modification?

Students are encouraged to explore related phenomena to broadly apply their new learning.

NGSS ASSESSMENT

In 2016, Scottsdale, Arizona, received one-third of its annual rainfall during the summer. Tucson, Arizona, received one-half of its annual rainfall during the same time period.

Figure 1 shows the typical annual rainfall, in inches, for different areas in the state.

Figure 1. Typical Arizona Rainfall



1

GUEST

Part A

Use Figure 1 to rank the Central, Southeast and Southwest Arizona regions by the typical annual rainfall.

| | Most Rainfall | Second Most Rainfall | Least Rainfall |
|-----------|--------------------------|--------------------------|--------------------------|
| Central | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Southeast | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Southwest | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Part B

Use Figure 2 to identify the time of the year during which each city receives the most rain. Select the boxes to choose the **best** answer for each city.



art A

A layer of clay separates two layers of sedimentary rock in Montana. Fossils of different mammal teeth are found in both of the sedimentary rock layers.

Figure 1 shows the locations of the sedimentary rock layers and the clay layer in between.

Figure 1. Clay and Rock Layers in Montana

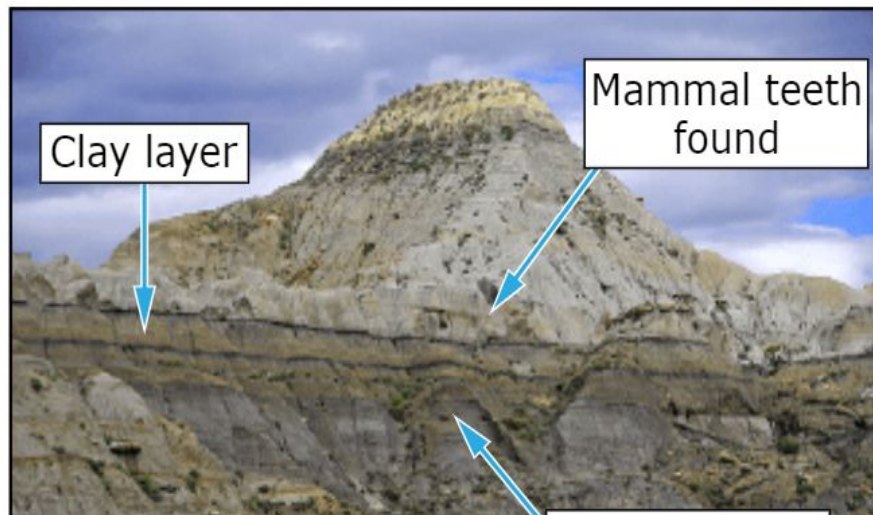
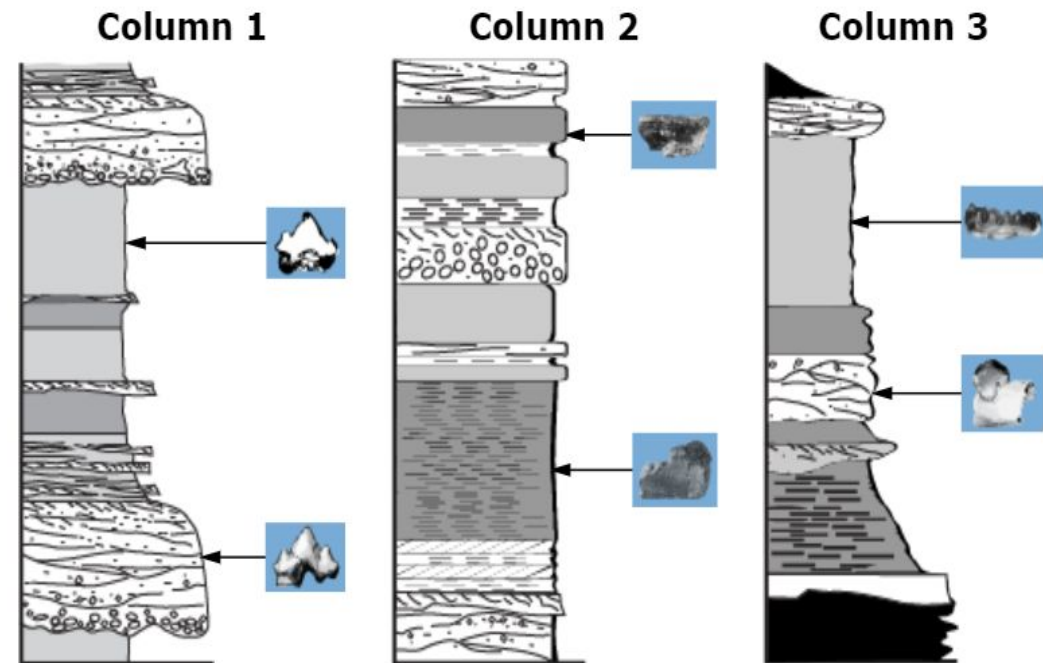


Figure 3 shows three geologic columns. These geologic columns represent the time periods from which some of the teeth in Table 1 have been recovered. The age at the bottom of each column represents the oldest known age for the teeth in that column.

Figure 3. Locations of Fossil Mammal Teeth



2019 NGSS Assessment Results

| | At /Above Goal |
|---------|----------------|
| Grade 8 | 80.7% |
| Grade 5 | 79.2% |

NGSS Standards

- Value performance over memorization
- Designed with a multilayered approach
- Engineering and design practices are woven throughout
- Possess direct CCSS links (Reading & Math)
- Assessments are multifaceted & dynamic

